Waste Management and Recycling in Dar es Salaam, Tanzania

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Waste Management and Recycling in Dar es Salaam, Tanzania

Joshua Palfreman

(2nd Edition)

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Executive Summary/Abstract

Dar es Salaam, Africa's third fastest growing city, has a serious waste problem. Situated on the shores of the Indian Ocean the city has all the potential to be one of the most beautiful in the world, instead, it is the world's eighth filthiest.

This report comprehensively examines Dar es Salaam's complex waste management and recycling situation. The report uses an eclectic methodology—sourcing a mix of original fieldwork, scholarly literature, official statistics and interviews in the UK, Tanzania and South Africa.

Chapter one of the reportintroduces the city profile of Dar es Salaam, presenting waste management issues in the city through a historical review before setting out the rational, aims and objectives of the report. Later a review of previous scholarship on waste in the city is critically analysed.

Chapter two of the report presents data from a waste collection and recycling experiment among fifty low-income households. The study—which was carried out in partnership with a local government authority—found waste production per capita as high as 0.56kg per day, a higher rate than previous estimates found in scholarly literature. The study also reported for the first time ever data on the composition of common household recyclables as well as general waste, the waste routes for disposal and public perceptions among householders on waste management and recycling issues.

Chapter three of the report was rewritten in 2014 for publication by WASTEDAR as an electronic conference paper titled 'Waste Picking in Dar es Salaam, Tanzania'.

analyses popularly recycled waste materials (such as plastic and paper) in Dar es Salaam and investigates their domestic and international value and trade among informal and formal actors in the waste recycling network operational in Tanzania and abroad.

Chapter six of the report investigates the health, environmental and business impacts of Dar es Salaam's waste problems largely through the review of peer reviewed journals published in Tanzania. It is concluded that poor waste management practices in Dar es Salaam seriously impact public health (exacerbating diseases like cholera, typhoid & malaria), adversely affecting the environment (causing flooding and groundwater contamination) and disrupting commerce (threatening the hospitality, tourism, and the food and beverage industries).

Chapter seven of the report provides a comparative review of legislation relating to waste management and recycling in Tanzania and South Africa. The review finds that laws in Tanzania, such as the 2009 Solid Waste Management Regulations are almost identical on paper to the South African 2008 Environmental Management: Waste Act. In implementation, however, the laws are worlds apart. Tanzania lacks South Africa's systems of enforcement, expertise and infrastructure. This asymmetry in implementation, it is argued, goes a long way to explain why Tanzanian environmental legislation fails to fulfil its purpose while its South African counterpart does.

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Abbreviations

CMW	Common Mix
DCC	Dar es Salaam City Council
DMDP	Dar es Salaam Development Project
EMA	Environmental Management Act
HDPE	High-density Polyethylene
HL1	Heavy Letter One
KMC	Kinondoni Municipal Council
NEMC	National Environmental Management Council
NGO	Non Governmental Organisation
OCC	Old Corrugated Cardboard
PET	Polyethylene Terephthalate
SWMR	Solid Waste Management Regulations

Chapter 1.0—Introduction

Situated on the shores of the Indian Ocean, Dar es Salaam is the third fastest growing city on the African continent and the economic powerhouse of Tanzania—East Africa's largest nation (The World Federation, 2013). While Dar es Salaam has the potential to be one of the most beautiful cities in the world, in reality it is one of the filthiest. In 2010, Dar es Salaam was rated as the world's eighth dirtiest city by NYC Consulting Group (Mwakyusa, 2010). The United Nations rates Dar's sanitation, waste management as 'well below average' (Siemens, 2010) and newspapers, pop artists and films mock the city for its unsightly and smelly vistas (IPP Media, 2013).

Dar es Salaam is a tropical city on the Indian Ocean,situated approximately seven degrees south of the equator. The average temperature throughout the year is 30 degrees Celsius; the average humidity is 80%. The city has two rainy seasons—one between October and December and the other between March and May (CIA, 2013). While the Tanzanian capital does not suffer from any natural weather hazards, flooding occurs during both rain seasons due to poor infrastructure and urban planning (i.e. lack of storm drains).

Dar es Salaam is the largest city in Tanzania. The city's population, which has grown from 840,000 in 1978 to roughly 4.34 million persons in 2013, accounts for approximately 10% of Tanzania's population. It's a young city—over half of the population are under twenty-five years old. It's politically split up into three districts, Ilala, Kinondoni and Temeke that cover an area of 1,800 km ^{2} of both water and land mass (CIA, 2013).

While the city is the economic hub of the country, conducting over 70% of economic activity, most of Dar's inhabitants (>60%) live in poorly constructed unplanned

1.1—The Historical Background to Dar es Salaam's Waste Problems

Waste management services in Tanzania began in 1961 (the year of the nation's independence) and continued under complete government control until 1994 under the authority of the Dar es Salaam City Council (DCC). The DCC did poorly in managing waste, collecting as little as 5.5% of the city's waste during this period due to a lack of finance, equipment, skilled personnel and appropriate disposal sites. The Tanzanian government did, however, make efforts to improve their collection rate through attracting foreign aid. Between 1983 and 1989, for example, the Tanzanian authorities sought aid from Japan and were awarded funding to acquire thirty refuse trucks and refuse containers, three skip trucks and six compacter trucks. The new equipment alone, however, without partnering expertise, human resources and maintenance plans, quickly deteriorated. By 1992, only three years after receiving the Japanese aid, twenty-six of the thirty refuse trucks, five of the six compacter trucks and two of the three skip trucks had all broken down (Solomon, 2011).

In dire straits and with little to no domestic funds, the Tanzanian government sought more aid from international donors. This time, however, donors, in the light of the Japanese experience, insisted that the government privatise waste management services. In 1992, the UNDP initiated The Sustainable Dar es Salaam City Project to link NGOs, businesses and governmental stakeholders and launch the privatisation of solid waste management services that would later begin in 1995 (Solomon, 2011).

By 2002, the collection rate of solid waste had risen to an impressive 30%, in part due to small enterprises and businesses being permitted to participate in solid waste management services. A significant contribution was made by Multinet Africa Company Limited, the first company to be formally contracted by the government for solid waste management services following privatisation in 1995. The roll out of

low (some 70% of clients did not pay their bills) and the government, which had failed to anticipate and plan for the consequence had no legislative framework to enforce the payment based collection service upon their clients. In practice, contractors were not paid, had no ability to utilise legal services and in time went bankrupt (Solomon, 2011).

Today, there are dozens of small enterprises offering waste management services across the city. It is estimated that 40% of Dar es Salaam's total waste production (estimated in 2011 at roughly 4,200 tonnes per day) now finds a formal or an informal route for disposal (DCC, 2011). The operations of waste companies however are often short-lived due to poor management, corruption and lack of finance. Among large contracted solid waste management contractors, Multinet, no longer exists—it went bankrupt (Solomon, 2011). Three companies that have surfaced and remained in place for several years are Tirima, Green Waste Pro and Eco Protection Limited. Their operations are discussed in greater detail throughout the report.

1.2—Rationale

Because Dar es Salaam, Tanzania is such a rapidly growing city, policy makers and stakeholders seeking to design and implement sound policy about waste management and recycling issues require accurate, relevant and up to date data and critical analysis of the issues (health, environmental and economic) involved. Unfortunately, such data and analysis are lacking.

- In 2015, Dar es Salaam (in partnership with the World Bank) will initiate the Dar es Salaam Metropolitan Project (DMDP) to develop waste management and recycling infrastructure and social services for the general public. Yet the latest literature on domestic waste and recycling available uses out of date data from 2006 (The World Bank, 2013).

- In 2009 the government passed the Solid Waste Management Regulations, the first ever-legal instrument exclusively targeted at waste and recycling. There is no literature critically analysing this potentially landmark piece of legislation.

The study provides a much needed comprehensive and up to date analysis of these important subjects—including domestic waste production, composition, waste routes for disposal and recycling initiatives and fills in knowledge gaps on the contributions of relevant stakeholders and legislative structure that exists in this field of research and practice.

1.3—Aims and Objectives

The aims of this study are to:

1. Investigate Dar es Salaam's waste management problem, examining the volume and character of the waste, the attendant economic, environmental and health consequences, and the political and legal dimensions of establishing a sustainable policy.

The objectives of this study are to:

1. To conduct a comprehensive review of literature relating to the above aims
2. To collect, sort, analyse and dump waste and recyclables from fifty low-income households in Dar es Salaam
3. To conduct one-on-one interviews and focus group discussions with multiple stakeholders in Tanzania and South Africa including: individual waste recyclers, middle men, doctors, environmentalists, economists, charitable, private, industrial, governmental actors and the general public.
4. To compare and contrast legislation in Tanzania and South Africa through

1.4—Methodology

The report used an eclectic methodology—sourcing a mix of original fieldwork, scholarly literature, official statistics and interviews in the UK, Tanzania and South Africa.

In chapter one, a comprehensive review of literature relating to waste management and recycling in Dar es Salaam, Tanzania is performed. This review included published studies (both peer-reviewed and non peer-reviewed), unpublished literature in English, and literature in the native language, Kiswahili. Scientific peer-reviewed journals were accessed via Science Direct (Elsevier), while more recent data and developments were sourced through Internet searches on Google News and Google Scholar. Hardcopy data from government offices, including legislation and municipal reports were accessed in hardcopy through the Dar es Salaam City Council and Google Internet searches.

Chapter two, which reports on a household waste audit, utilised a methodology similar to that of Kaseva & Mbulingwe (2005, p.353) and Kaseva, *et al.* (2002, p.243). A four week long waste collection and recycling experiment was conducted among fifty households (some 268 persons) on Togo Street in the 'Kinondoni A' Ward of Kinondoni District, Dar es Salaam between 1st and 29th August 2013 in partnership with the Waste Management Department of the Kinondoni Municipal Council (KMC). Two receptacles were provided to each household (one for general waste and one for dry recyclables), waste was collected once weekly using a lorry and four labourers procured by the KMC. Waste was then transported to a compound owned by the KMC in Kinondoni District, sorted into general waste and recyclable categories, weighed and then disposed of either at the city dumpsite or at an informal recyclers co-operative. Data on the waste weight, composition and routes of disposal

employed in getting rid of waste and the knowledge among respondents of applicable national and local legislation on waste management.

Chapter three of the report was rewritten in 2014 for publication by WASTEDAR as the electronic conference paper ‘Waste Picking in Dar es Salaam, Tanzania’.

Chapter four of the report delineates for the first time the roles of various stakeholders—government, private, civil society, general public—working exclusively in this major issue. Stakeholder included government agencies (the Ministry of Natural Resources and Tourism, the National Environmental Management Council, the Dar es Salaam City Council and the Ilala, Kinondoni and Temeke Municipal Councils), private sector actors (including Green Waste Pro, Tirima and Eco Protection Limited) and charitable actors (including Nipe Fagio, Wonder Workshop, Africraft, Neema Crafts Café, Shangaa, The Green Room, Jane Goodall’s Roots and Shoots and the Bremen Overseas Research and Development Association).

Chapter five of the report reports on the market trends of the domestic and international recycling market, sourced from a series of one-on-one interviews with key waste producers and recyclers. These included senior management at five leading industries in Tanzania: Coke, Pepsi, Bakheresa, SAB Miller Breweries and METL and telephone interviews with representatives at Silafrica, Victoria Moulders, Centaza Industries Limited, Kiboko Industries, Bonite Bottlers Limited, Jumbo Packaging Printing Company Limited, Papcot Company Limited, Tanpack Industries Limited, Kioo, Dar es Salaam Glassworks, Aluminum City Limited, Selebhai Glass, Aluminum Limited and Shamo Group. Specific focuses in each interview included: the industrial source and quantity of recycled and virgin materials, how recyclables are processed and to create what, how much processed material is used within Tanzania and how much is exported and what the average rates for the trade of

with it, or alternatively, give their own opinion on what they felt were the most significant, health, environmental or economic consequences of waste.

Chapter seven of the report, which provides a comparative review of waste management legislation in Tanzania and South Africa, utilised the human and infrastructural resources of environmental experts and private sector waste recycling companies in South Africa. The focus of the site visits and discussions with the Environmental Coordinators was to gain an understanding of the infrastructural, enforcement and legislative structures in place in South Africa in order to compare with Tanzania.

1.5—Literature Review

Previous studies of waste management and recycling in Dar es Salaam are flawed in several respects. Firstly, many studies utilise data that while acquired with commendable methodologies and procedures are now very dated (commonly late 1990's). The literature is therefore out of date and misrepresentative of the Dar es Salaam city profile. Dar es Salaam is expanding and changing so rapidly that studies can become obsolete quickly. Since the last report by Kaseva & Mbulingwe (2005, p.353) (which presented data on household waste production from household waste audits) the population of Dar es Salaam has grown by over two million inhabitants. Another study by Kaseva & Gupta, 1996 that studied the waste routes and infrastructure for disposal in Dar es Salaam atthe Vingunguti dumpsite is now of purely historical interest only; as the author of this report notes, the Vingunguti dumpsite has been closed since 2001 and been replaced by the Pugu Kinyamwezi dumpsite. Lastly, studies that have included financial and monetary data have confused matters by quoting in the local currency, the Tanzanian Shilling, a currency with one of the highest inflation rates in the world (and only recent exchangeable data with the US dollar). This has left studies such as Kasevea & Gupta (1996, p.299) and Kaseva, *et al.* (2002, p.243) impossible to understand, due to readers not

et al(2002, p.243) present substantial differences in estimates on the average income per informal waste recycler. Kaseva & Gupta (1996, p.299) argue that the income potential for one waste amounted to three times the minimum wage, while in Kaseva, *et al.*(2002, p.243) this income potential had shrunk to only twice the official minimum wage.

There is much more consensus regarding the health, environmental and business impacts of poor waste management practice. Health impacts such as cholera, typhoid, and malaria as a result of poor waste management practice were noted by Dodman, *et al.* (2011, p.3), Penrose, *et al*(2010, p.1), Sattler, *et al*(2005, p.1), Castro, et al. (2009, p.1475), Badowski, *et al.*(2011, p.1) and a key informant interviewed in this study at the Muhimbili National Hospital in Dar es Salaam. Consensus on the environmental impacts of poor waste management practice, particularly in relation to flooding and water contamination were found in journal articles by Sugden (2006, p.2), Sakijege, *et al.*(2012, p.1), Kiunsi (2013, p.321), Machiwa, (1992, p.562), and Mwegoha & Kihampa (2010, p.763). Lastly, there is consensus on the business impacts of poor waste management practice, particularly on the tourism and hospitality industries. See, for example Kaseva & Mbulingwe (2005, p.353), Kaseva & Moirana (2009, p.695), Kiunsi (2013, p.321) and a key informant interviewed in this study at Tanzanian Investment Centre that seeks to attract foreign and domestic investors to invest by beginning businesses in Tanzania.

Chapter 2.0—Domestic Waste Production, Composition & Perspectives, the Togo Street Experiment

The previously mentioned Togo Street experiment found that the average general waste and recyclables production per capita per day was approximately 0.45 kilograms and 0.11 kilograms respectively. A comprehensive chart of general waste and recyclable sub-categories weighed each week is presented in Table 2.1 and 2.2

The experiment found substantial discrepancies in waste levels between week one and weeks two, three and four. This may derive from a methodological artefact with the Togo Street experiment. Focus groups and measured on site data revealed that in the first week of the study an atypically large amount of accumulated waste was disposed of. This was likely the case because no waste service existed before the Togo Street experiment came into place. As a result the per capita per day average from the Togo Street experiment is disproportionately high in week one.

Secondary data reviewed from Kaseva & Mbulingwe (2005, p.353) and Kaseva, *et al.* (2002, p.243) that conducted similar household waste audit based studies indicated lower per capita per day waste production levels than those recorded from the Togo Street experiment. Table 2.3 below portrays the main differences in methodologies and data recorded between the Togo Street Experiment and Kaseva & Mbulingwe (2005, p.353) and Kaseva, *et al*(2002, p.243).

Table 2.1—Cumulative General Waste Composition (Togo Street)

Item (kgms)	Week #1	Week #2	Week #3	Week #4	TOTAL	% of TOTAL
Food	1048.72	604.52	608.23	602.12	**2863.59**	**84.80%**
Tissue paper	93.26	63.28	62.91	54.82	**274.27**	**8.12%**
Plastic (LDPE)	33.26	12.45	12.82	11.96	**70.49**	**2.09%**
Tetrapak	56.42	22.14	23.83	22.91	**125.3**	**3.71%**
Hazardous	10.44	5.32	4.89	4.71	25.36	**0.75%**
Textiles	7.44	3.24	3.85	3.26	17.79	**0.53%**
TOTAL	**1249.54**	**710.95**	**716.53**	**699.78**	**3376.80**	**100%**
Per capita					**0.4498**	

Table 2.2—Cumulative Recyclables Composition (Togo Street)

Item (kgms)	Week #1	Week #2	Week #3	Week #4	TOTAL	% of TOTAL
Paper	39.91	18.32	14.22	17.11	**89.56**	**10.85%**
Cardboard	55.42	15.42	18.33	17.45	**106.62**	**12.92%**
Plastic (PET)	59.33	23.44	21.62	22.84	**127.23**	**15.41%**
Plastic (HDPE)	33.28	14.22	16.11	10.63	**74.24**	**8.99%**
Cans	65.43	21.03	18.93	22.74	**128.13**	**15.52%**
Glass	50.24	15.23	20.14	17.88	**103.49**	**12.54%**
Bones	121.84	35.42	38.91	32,66	**196.17**	**23.77%**
TOTAL	425.45	143.08	148.26	108.65	825.44	100%
Per capita					0.109	

Table 2.3—Comparison of Primary and Secondary Data on Domestic Waste

Study	Palfreman (20 p.17)	Kaseva, *et al.* (2 p.243)	Kaseva & Mbulingwe (2005, p.353)
Waste production per capita, per day	0.56	0.39	0.40
Duration of study	Four Weeks	Three to Four Months	Three to Four Months
No. of households participating	50	250+	300+
No. of collections per week	One	Four	Three

2.1—Waste Routes for Disposal

In partnership with the Kinondoni Municipal Council, general waste (a grand total of 3.37 metric tonnes) was dumped at the Pugu Kinyamwezi city dumpsite and recyclable waste (a grand total of 825.44 kilograms) was handed over to a co-operative of informal waste recyclers situated one kilometre from Togo Street on Kinondoni Road, Kinondoni District, Dar es Salaam. As Tanzania has no hazardous waste disposal facility, hazardous waste was mixed with general waste and dumped at the city landfill.

The Togo Street experiment was unable to determine the subsequent routes the recyclables collected took after being passed onto the recyclers co-operative due to the small quantity of recyclables collected, however trends and recycling possibilities related to informal recycling systems (i.e. individual waste recycling) and formal waste recycling systems (i.e. domestic and international trade of waste items) are discussed in greater detail later in this report.

The Pugu Kinyamwezi Dumpsite

The Pugu Kinyamwezi city dumpsite—the only official dumpsite in Dar es Salaam—is situated thirty-five kilometres from the city centre in the Ilala Distrct. It covers an area of approximately 75 hectares—the size of some 75 rugby fields. Despite being managed by the Dar es Salaam City Council, the dumpsite operates in some of the most deplorable conditions imaginable.

Kihampa, (2013, p.198) reported that a 2004 Environmental Impact Assessment commissioned by the Dar es Salaam City Council (DCC) and conducted by the Environmental Resources Consultancy group recommended that certain protective measures should be put in place *before* the Pugu Kinyamwezi area was used as a dumpsite. These included the installation of full leachate and gas management

Despite this advice, however Kihampa, (2013, p.198) reports that the Pugu Kinyamwezi dumpsite opened in 2007 with no leachate and gas management systems, no strategy for individual waste recycling, and no installed infrastructure other than a weigh bridge that subsequently broke in 2010 and has since never been repaired. Kihampa, (2013, p.198) highlights gross misconduct and misuse of the dumpsite, in one example, the study cited that between 1,200 and 1,600 tonnes of hazardous, electronic and medical waste is dumped on the dumpsite weekly.

The waste disposal operations at the Pugu Kinyamwezi city dumpsite directly violates both the EMA 2004 that requires hazardous waste types to be treated through safer and less hazardous disposal routes (EMA, 2004) and the Solid Waste Management Regulations 2009 that require landfill sites to be built with full leachate and gas management systems (SWMR, 2009).

2.2— The Politics of Waste—Public Perceptions of Waste Management and Recycling

A range of issues relating to domestic waste management and recycling were discussed during focus group discussions. Specific questions and prompts were used by the moderator of both focus group discussions to gain a general understanding on key domestic waste issues covered in the Togo Street experiment.

1. Focus group discussion (FGD) participants found waste management important for their households and local community but unimportant in comparison with other basic necessities. Participants were asked to rate the importance of each service 1-5 (1=not important/5=important).

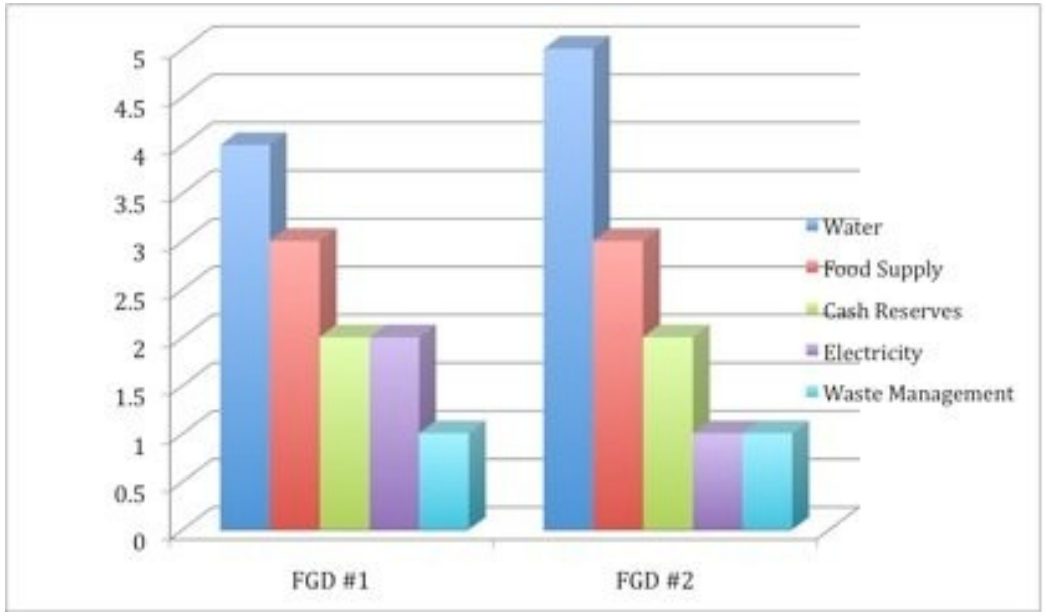

Figure 2.4—Comparative Importance on Waste Management

Figure 2.5—Preferred Waste Route for Disposal

3. FGD participants had little to no knowledge on the national and local by laws that banned the illegal waste routes for disposal employed by households.

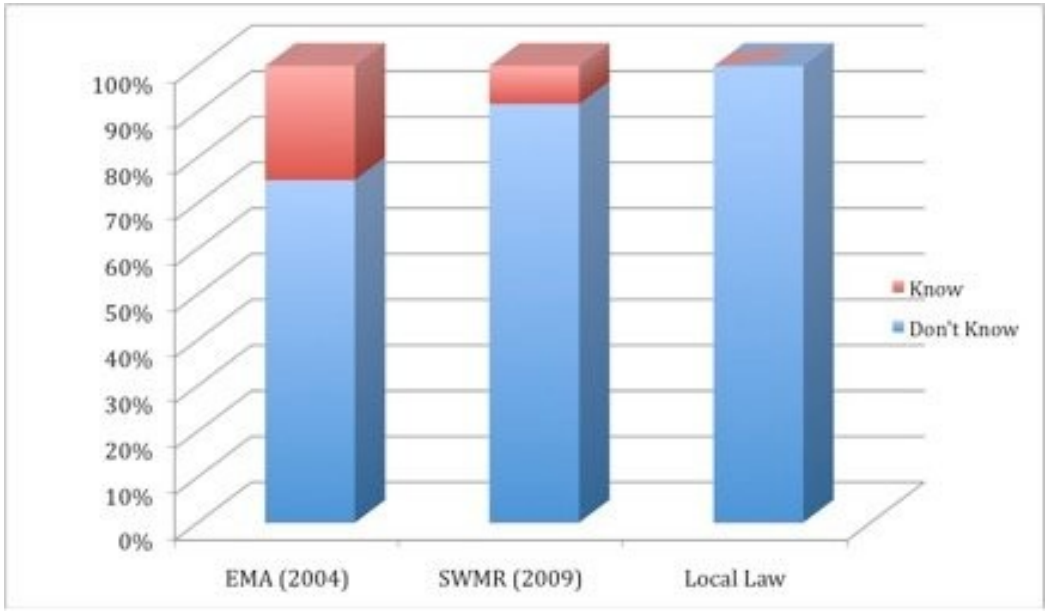

Figure 2.6—Knowledge of Applicable Legislation

Chapter 3.0—Recycling in the Informal Sector: The

Chapter 4.0—The Unrecognised Role of the Formal Sector: Government, Business and NGOs

Part three of the report delineates for the first time the roles and responsibilities of various stakeholders in this major issue, critically reviewing their focuses, successes and shortcomings.

4.1—Government

Government agencies are tasked with the important duty of designing, implementing and enforcing legislative structures in regard to waste management and recycling in Dar es Salaam and nationally across Tanzania. While information on the focuses of each governmental agency are sufficiently communicated to the general public online, in print and physically through their offices, the successes and shortcomings of all agencies reviewed are not well documented, often not existing online or in print at all or only existing through third party websites not associated with the government.

Table 4.1—Governmental Agencies (Focuses, Successes and Shortcomings)

Agency	Focuses	Successes	Shortcomings
The Ministry of Natural Resources a Tourism	Designing, promoting and distributing legislation in relation to environmental issues, including waste management and recycling	Design and publication of Environm Management Act (2004) and the Sol Waste Management Regulations (20	Legislation is not available in hardcopy at The Ministry of Natural Resources and Tourism or o their website. Legislation is only available from third party websites, not associated with the Tanzanian Government.
The Nationa Environmen Managemen Council (NEMC)	Enforcing environmental legislation and setting environmental standards through licensing, research and the registration of environmental experts in the country. Issuing, approval and/ refusal of waste management an recycling licenses for collection, processing or transport based operations and Environmental Impact Assessments.	Recent partnership with Nipe Fagio, GIZ and the Kinondoni Municipal Council to clean, restore and set up an on the spot fine enforcement system for the Mlalakua River that floods annually due to illegal waste dumping and a complete ban on the trade of plastic bags from supermarkets and a ban on the trade of plastic bags for all other purposes under 0.3 microns.	Successes are not reported on the NEMC websi or through the media. The latest annual report published online dates back to 2006. The plasti bag ban meant to roll out in July, 2013 has still not been released on the NEMC website or through the media. No guidelines or fine and disciplinary procedures on enforcement of the ban have been provided to the enforcement department of NEMC.
The Dar es Dar es Salaa City Council (DCC)	Complements waste management operations by each of the three city municipal councils (Ilala, Kinondoni, Temeke) by providing seven vehicles and ten staff for the disposal of waste in public areas in addition to the resources that are independently held by each municipal council	Plans to construct transfer stations and a sanitary landfill site beginning in 2014. Partnership with the World Bank on Phase 2 of the Dar es Salaam Metropolitan Development Project (DMDP) worth over $75 million that will seek to improve and increase funding, resources, equipment and infrastructure to develop waste management and recycling systems.	No official print or online information by the DCC concerning plans to construct transfer stations is available. No official print or online information on the DMDP Phase 2 Project is available from the DCC or the media. All information was sourced from interviews with the DCC and the World Bank.
The Ilala, Kinondoni an	Management of independently and sub-contracted private companies to	The Ilala Municipal Council under the direction of Mayor Silaa has taken	No print or online information is available on either the Ilala Beautification Project or the Waste

Temeke Municipal Councils	manage waste in their respective districts. Public areas, roads and offices particularly in the Ilala District where the majority of Dar es Salaam's parks and public areas are situated are managed by the municipal council while all private properties are managed by private waste management companies.	leadership on waste management issues in Dar es Salaam, founding the Ilala Beautification Project in 2012 that saw many public areas refurbished and redesigned to include basic street furniture such as benches and bins. Each municipal council has also formed an independent waste management department to address waste management and recycling issues.	Management Departments at each municipal council. As a result contact details are not available and physical visits to each municipal council were necessary.

4.2—NGO's and Charitable Organisations

NGOs and charitable organisations have stepped up their focus on waste management and recycling programmes since 2010 of new legislation (i.e. the Solid Waste Management Regulations 2009) and public outcry on health, environmental a consequences of Dar es Salaam's waste (Daily News, 2013). While capable of making strong statements and leading by example, a common trend of scalability and lack of funding consistently came up as a shortcoming at the organisations.

Table 4.2—NGOs and Charitable Organisations (Focuses, Successes and Shortcomings)

Organisation	Focuses
Nipe Fagio	Advocacy and networking organisation that acts as a consortium of civil society, private, governmental and environmental actors whom have an interest in waste management and recycling issues for a range of reasons, from passion in environmental management to corporate social responsibility. The organisation offers a networking platform for various actors from various sectors to meet and collaborate on a monthly basis.

Wonder Workshop, Africraft, Neema Craft Shangaa and The Green Room	Advocacy for waste reuse and recycling through art. The organisations collects and recycle waste and create arts and crafts from the recycled waste to sell.
Jane Goodall's Roots and Shoots	Provides educational materials and lessons regarding waste management and recycling in Dar es Salaam through its secondary school network.
Bremen Overseas Research and Developmen (BORDA)	Provides technical guidance on waste and recycling systems and engineers these systems too for small clients such as schools, clinics and farms.

4.3—The Private Sector

The day to day operations of privately contracted waste management and recycling companies in Dar es Salaam carry the mass of the burden in cleaning up the city and managing waste. Taking a closer look at the reach and scale of the three largest private sector waste service providers: Green Waste Pro, Tirima and Eco Protection Limited, it is clear that the focuses of each company are very similar.

While the assets controlled by Dar es Salaam's three leading waste management companies are impressive, the companies operate an elementary operation, starved from innovation. Private waste service providers only service wards in the city centre, along the city peninsula and in isolated areas of national importance such as the airport, port, national stadium and national/international bus terminal. Once waste is collected private actors simply compact and dump the waste at the Pugu Kinyamwezi city dumpsite. No efforts are made by the companies to diversify services (i.e. providing standardised waste receptacles, offer recycling services, improving web services so collections can be scheduled and payments can be made online).

Despite the simplicity of their operations, waste management companies report a long list of challenges they face in their provision of services to clients, these include:

- ***Rate of bill payment*** from clients to waste service providers is shockingly low. Many householders refuse payment for waste management services. Kaseva & Gupta (1996, p.299) and Kassim & Ali, (2006, p.769) show that on average only 40% to 50% of clients pay fees to their waste management contractor for services on time or at all. Discussions held by the author with key informants of the sector relate closely to these figures also finding that on average the rate of payment to contractors is 55% to 60%. Key informants felt that key reasons

the same amount as clients who rely entirely on the waste management service for waste disposal solutions.

- Administrative challenges preventing effective enforcement; relating to the lack of enforcement staff, incompetence, corruption and inefficiency of the police and court system and lack of distance based communication options to pursue clients (i.e. landline telephone, email, personal mail box).

- ***Long distance to Pugu Kinyamwezi*** dumpsite was cited by key informants as the second most significant financial challenge to waste management service providers. Key informants revealed that traffic congestion made the journey to the dumpsite even more costly, claiming that their vehicles were only able to make one to two visits to the dumpsite daily due to spending an average of two to four hours on each trip in traffic.

- ***Poor compactor technology maintenance*** was identified by key informants as an additional barrier to efficient and economic performance. Poor road quality, high organic and wet content in compacted waste and high levels of heat, humidity and dust in Dar es Salaam led to frequent maintenance requirements of vehicle compactor technology and internal electronics.

Chapter 5.0—The Economics of Recycling: A Material & Market Analysis

Part four of the study provides the first ever market analysis for informal and formalised waste recycling operations and efforts in Dar es Salaam. The study analyses popularly recycled waste materials in Dar es Salaam and investigates their domestic and international value and trade among informal and formal actors in the waste recycling network operational in Tanzania and abroad.

5.1—Plastics (PET and HDPE)

PET and HDPE plastics are the most widely produced, recycled and processed plastic based waste materials in Tanzania among both informal and formal recycling networks. In Tanzania, Bakheresa Industries, METL, Coke, Pepsi and Tanzania Breweries Limited are the largest producers of PET while Silafrica, Victoria Moulders, Centaza Industries Limited and Kiboko are the largest producers of HDPE.

While the plastics recycling industry is both busy and lucrative a report reviewing the plastics industry in Tanzania by the London School of Economics (LSE) presented a number of key barriers to the growth and development of the plastics recycling industry in Tanzania. These included: the absence of a 'class A' PET pellet service (a high enough quality for bottle to bottle recycling, where virgin material is not required), a high dependency on plastics imports due to the lack of infrastructure and technology, a high excise duty on plastics (120% compared with 50% for Kenya) and an unreliable electricity grid as well as corruption and inefficiency at the Dar es Salaam port (LSE, 2013). As an influx of PET hits the Tanzanian market (due to Coke, Pepsi and Tanzania Breweries Limited switching from glass to PET bottling lines, the Tanzanian government must better facilitate the trade of recycled plastics.

Table 5.1—Market Analyses (Plastics—PET and HDPE)

Item	Source	% of trade domestic/international	Production	Recycling Process	Output
Polyethylene terephthalate (PET)	90% of PET is recycled by individual waste pickers in the form of plastic beverage bottles.	30% of recycled PET is processed and resold in Tanzania. 70% is exported, mostly to China, India and Indonesia.	4,000 tonnes per month	In the most basic form for recyclable processing, PET can be baled, to create highly compacted PET. This allows PET to reach an efficient and economic payload in containers for export. A second option for the processing of PET is chipping or flaking PET in a grinder to create even higher payloads in containers for export. The third and most expensive and sophisticated processing option for PET is the melting and extrusion of PET that has already been chipped or flaked. This process produces PET granules or pellets that has the highest payloads in containers for export.	Alexander and Reno, 2012, p.106 report that PET flakes/chips most commonly act as fibre filling for toy animals, furniture, carpets and interior fabrication of cars. Bakheresa Industries in Tanzania processes and uses PET granules/pellets at a rate of 30% to 40% in the production of new line bottles when mixed with virgin PET. PET recycled by Bakheresa is not Grade A PET and can thus not be used at higher rates for the production of new line beverage bottles due to clarity issues.
High-density polyethylene (HDPE)	95% of HDPE is recycled by individual waste pickers.	20% of recycled HDPE is sold and processed domestically, 80% is exported.	1,500 tonnes per month	HDPE can be bailed or grinded into chips/flakes for more efficient and economic payloads in export and domestic transport.	Recycling and processed HDPE is turned into polypropylene woven sacks by Bakheresa Industries and coils, pipes and hard plastic containers by Kiboko Industries.

5.2—Paper Products

The grand majority of paper products in Tanzania including white paper (HL1), common mix (CMW) and cardboard (OCC) are imported. The trade of recycled paper products is far less organised and sophisticated than that for plastics but functions significantly differently depending on the quality of the paper product needing to be recycled.

When paper products are clean they are recycled very easily via market vendors whose more professional and formalised setting in market places attract the general public and office workers to recycle comfortably. Once recycled paper products become wet or damaged however, independent waste recyclers and middlemen return. Clean paper product recycling options are available at the Kariakoo, Buguruni, Kinondoni, Kisutu and Kivukoni Markets among others while damaged paper recycling is commonly recycled and processed by Bonite Bottlers Limited, Jumbo Packaging Printing Company Limited, Papcot Company Limited and Tanpack Industries Limited in order to produce tissue products and paper cartons.

Table 5.2—Market Analyses (Paper Products)

Item	Source	% of trade domestic/international	Production	Recycling Process & Output
News, white and brown paper (clean	80% is recycled by small market vendors that buyback clean, undamaged news, white and brown paper from the general public. 20% is sourced from individual waste recyclers that sell to the same market vendors.	90% of news, white and brown paper is sold and reused in Tanzania.	140,000 tonnes of brown kraft by Tanzania Paper Mills Company. 200,000 tonnes of imported white and news	Market vendors sort recycled paper and create envelopes, cards and wrapping paper by hand, using paper glue and scissors. They then wrap the paper material for resale that is subsequently used widely across the city by other market vendors as a cheaper alternative to plastic bags for product wrapping.
News, white and brown paper and cardboard (damaged)	90% is recycled by individual waste recyclers,	90% of waste is reused in Tanzania.	Same as above, it is expected that 5,000 tonnes of cardboard are imported into Dar es Salaam monthly.	Tanpack Industries, the sole industrial buyer of news, white and brown paper for domestic use produces tissue paper products from processing recycled paper.

5.3—Glass

Glass recycling is led by breweries and beverage companies in Tanzania that hold existing relations to local glass producers who they source their bottles and glassware from. Due to variety of reasons (i.e. accidents, spillages, rejected bottles) the companies accumulate large quantities of broken glass and are therefore in an ideal position to recycle back to glass producers. Kioo Glass Limited, Dar es Salaam Glassworks (DGW), Aluminum City Limited, Selebhai Glass, Aluminum Limited and Shamo Group are the key players in the glass industry in Dar es Salaam.

Table 5.3—Market Analyses (Glass)

Item	Source	% of trade domestic/international	Production	Recycling Process & Output
Glass	90% is recycled directly from beverage and bottling companies to Kioo Industries. 10% is recycled by individual waste pickers.	100% of glass is sold, processed and reused in Tanzania. Due to the low returns and complications in processing recycled glass, it is not economical to export glass to overseas markets.	50,000 tonnes per month produced in Tanzania.	Glass is washed, sorted by colour, melted and remodelled into new glass products.

5.4—Bones

Bone processing industries in Dar es Salaam (centralised around the Buguruni area of Dar es Salaam) run a simple and inexpensive processing operation for sale to a domestic market. This cuts out middlemen recycling sites allowing individual waste recyclers to sell at any quantity and benefit from higher and more consistent pricing. There are currently no international bone trade operations operating in Dar es Salaam.

Table 5.4—Market Analyses (Bones)

Item	Source	% of trade domestic/international	Production	Recycling Process & Output
Bones	100% is sourced from individual waste recyclers who source bones from butchers, restaurants and bars	100% of recycled bones are sold, processed and reused in Tanzania. Due to the low returns and complications in processing recycled bones, it is not economical to export glass to overseas markets.	20,000 tonnes per month	Bones are taken to small industries, grinded down and sealed in plastic sachets for sale as various types of livestock feed. Bones can also be sold to Lara Industries Limited that produces basic kitchen items such as plates and mugs from animal bones.

5.5—Comparative Analyses of Material Valuation

While individual waste recyclers normally source their recyclables for free, the valuation of their product is substantially undermined in comparison with the formal industry based recycling market domestically and internationally. The variations in price for PET for example is stark. PET that is flaked will fetch an average of 700 USD per tonne within the international market while if PET is processed into granules/pellets it can fetch as high as 1,700 USD per tonne, more than five times the metric tonne value that PET is normally bought for from waste pickers and informal recycling points across Dar es Salaam. As discussed above, many recyclables are only traded domestically (i.e. bones), while others are traded more directly from source to industry more independent of the informal recycling network (i.e. cardboard).

Table 5.5—Market Valuation Analyses

Item	Source to Recycler	Recycler to Recycl Point (kg)	Recycling Point to Dom Industry (kg)	Domestic Industry to National/International M (metric tonne)
PET	Free	0.20-0.26 USD	0.36-0.43 USD	700-1,700 USD[1]

[1] PET prices vary significantly depending on whether they are sold as flakes or granules/pellets.

HDPE Plastic	Free	0.15-0.21 USD	0.25-0.30 USD	500-600 USD
Paper	Free	0.17-0.24	0.29-0.35	500-600 USD
Cardboard	Free	N/A	N/A	60-70 USD
Glass	Free	N/A	N/A	40-50 USD
Bones	Free	N/A	0.12-0.18 USD	N/A

Chapter 6.0—Adverse Consequences of Dar es Salaam's Waste Problem

6.1—Health Consequences

Research has clearly supported the argument that poor waste management practice has led to the degradation of health, particularly among low-income residents living in unplanned settlements across Dar es Salaam.

In 2006, the Ministry of Health reported that 60% to 80% of hospital admissions were due to sanitation related diseases. Health officers at the Temeke Municipal Council additionally reported that 97% of out patients attending health centres were suffering from sanitation-related diseases (Sugden, 2009). Dodman, *et al* (2011, p.3) estimated that up to 93% of urbanites relied on pit latrines, 5% had access to septic tanks or sewage and 2% more had no formal excreta disposal facility. While many of the illnesses contracted due to poor hygiene and sanitation are easily remedied, the health situation has been exacerbated by the lack of human resources in the health sector of Tanzania, the Medical Association of Tanzania for example reported in 2010, that the doctor-to-patient ratio stood at 1:30,000 (MAT, 2010).

Specific diseases that have been related to improper waste management practice include:

- **Cholera**, that the Ministry of Health reported 7,000 cases of between 1998 and 2005 and which Penrose, *et al* (2010, p.1) associated with poor solid waste management in a study of several unplanned settlements in low income areas of Dar es Salaam.

- **Diarrhoea** (Mat Badowski, *et al.*, 2011, p.1) associated with poor household waste management around the household.

6.2—Environmental Consequences

Improper waste management practice in Dar es Salaam has led to severe environmental degradation. The most prevalent risks presented through a review of secondary data includes increased flooding risk, soil and water contamination and the degradation of marine life by the migration of heavy metals from the city's waterways into the Indian Ocean.

Sugden (2006, p.2) reported that of test boreholes drilled in the unplanned settlement areas of Buguruni, Manzese and Mabibo roughly 30% showed nitrate values exceeding the WHO recommended levels for drinking water of 50mg/l. This contamination likely resulted from fertilser run off. Contamination of soil and water is a regular occurrence due to the lack of proper sewage and rainwater catchment systems in the city, particularly in unplanned settlements.

Sakijege, *et al.* (2012, p.1) and Kiunsi (2013, p.321) found increased flooding risk in three wards of Dar es Salaam due to solid waste being dumped into storm drains and other waterways as an informal solution for waste management.

Machiwa, (1992, p.562) identified high concentrations of the extremely toxic heavy metal cadmium in the Msimbazi River along the Dar es Salaam coast that in turn led to degradation in the marine environment. This is a serious economic concern for a city that relies so heavily on its trade of fish from the Dar es Salaam coast.

In a study that tested water contamination in three wards surrounding the Pugu

Mwegoha & Kihampa (2010, p.763) found traces of cadmium and copper and higher levels of chromium and lead than permitted by the World Health Organisation and Tanzania Bureau of Standards in the Msimbazi River valley—a popular area for vegetable farming. The finding of heavy metals in the soils surrounding popular vegetable farms poses clear environmental and food safety risks.

6.3—Economic Consequences

Opinion research and government reports by Kaseva and Moirana (2009, p.695), the International Ocean Institute—USA (IOI, 2009) and the Dar es Salaam City Council (DCC, 2011) all found that the failure to manage waste would have an adverse impact on the attractiveness of the tourism and hospitality industry in Tanzania.

Where preventative measures have not been taken the economical consequences of poor waste management have been clearly seen in Dar es Salaam as well as in other major urban centres across Tanzania. Kiunsi (2013, p.321), for example, reported on the need for many businesses in the city to close due to the severity of the waste problem particularly after seasonal rains when flooding is common. In another example in 2012, seven luxury tourist hotels in Arusha and one luxury tourist hotel in Dar es Salaam were fined, closed or shut down by local authorities and the National Environmental Management Council due to illegally routing their liquid waste and sewage into waterways including the Indian Ocean (Twenty Four Tanzania, 2013).

Such incidences have led to organisations—such as The Honeyguide Foundation—which seeks to protect Tanzania's national heritage, partly through sustainable tourism—to publish a report on waste management to emphasise the importance of this issue in tourism and hospitality (Honeyguide Foundation, 2010). Additionally, Dr. Batilda Buriani, the Tanzanian Minister of State in the Office of the Vice-

Chapter 7.0—Waste Management Legislation: A comparative review between Tanzania and South Africa

Chapter seven of the report provides a comparative review of legislation relating to waste management and recycling in Tanzania and South Africa. The review finds that laws in Tanzania, such as the 2009 Solid Waste Management Regulations are almost identical on paper to South Africa's 2008 Environmental Management: Waste Act. In implementation, however, the laws are worlds apart.

7.1—Tanzanian Legislation vs South African Legislation

The two pieces of official environmental legislation that relate to waste management and recycling in Tanzania are the Environmental Management Act (2004) and the Solid Waste Management Regulations (2009). On paper, both acts portray a legislative framework that if enforced and implemented correctly would lead to an ideal waste management and recycling strategy in Tanzania. In practice, however, the legislation is little more than rhetoric. From the lack of detail on enforcement procedures and penalties to the absence of an implementation strategy (or even the very infrastructure that is referenced in the acts that in reality do not exist), the legislation is wholly inadequate to address Dar es Salaam's waste crisis.

It is instructive to compare Tanzania's legislative inventory in relation to waste management and recycling with that of another country in sub-Saharan Africa—South Africa. As we will see, South African legislation has similar objectives to Tanzania, but provides the resources and enforcement muscle to make the law a realistic achievement.

Table 7.1—Comparative Review of Tanzanian and South African Legislation Relation to Waste Managem

REF	Solid Waste Management Regulations (2009)—U of Tanzania	REF	Environmental Management: Waste Act (2008)—Rep South Africa
38 (p.23)	Local government authorities shall ensure that [individual waste recyclers] (a)- have adequate and appropriate working equipment and tools, training and adequate provision of personal of protective gears to waste handlers, (b) have the capacity to carry out segregation o waste including recyclable wastes.	**N/A**	Individual waste recyclers are unrecognised in South African legislation. (Schoeman & Sentime, 2010) report that, 'one of the most recent challenges emanating from the recently promulgated National Environmental Management: Waste Act 2008 is that it does not recognise the role of 'waste pickers' in municipal waste management'.
46 (p.28)	Any person who…liters…including in storm-water drains; or fails to collect litter found outside his premises commits an offence	**6 (26) (p.40)**	No person may dispose of waste, or knowingly or negligently cause or permit waste to be disposed of, in or on any land, water body or at any facility unless the disposal of that waste is authorised by law; or dispose of waste in a manner that is likely to cause pollution of the environment or harm to health and well-being.
9 (1) (p.8)	Any person who wishes to deal in solid waste as collector, transporter, depositor or manager shall apply to a government authority for a permit	**5 (24) (p.38)**	No person may collect waste for removal from premises unless such person is a municipality or municipal service provider; authorised by law to collect that waste, where authorisation is required; or not prohibited from collecting that waste.
15 (1) (p.13)	Every occupier of any premises shall be obliged to use receptacl approved by a government authority. Any person who does not ensure that reusable receptacles are kept clean, maintained and in good repair and ensure that each waste receptacle is used in a w which protects the contents from spillage, rain, storm water, birds flies or other pests and vermin commits an offence.	**5 (21) (p.38)**	Any person who stores waste must…ensure that the containers in which any waste is stored, are intact and not corroded or in any other way rendered unfit for the safe storage of waste; adequate measures are taken to prevent accidental spillage or leaking; the waste cannot be blown away; nuisances such as odour, visual impacts and breeding of vectors do not arise; pollution of the environment and harm to health are prevented.
17 (1)	No person shall deposit into any receptacle any hazardous substance unless that receptacle has been approved to contain hazardous wastes.	**15 (a)**	All persons must recycle all hazardous wastes and ensure that all collectable hazardous waste is placed into containers that will

(p.14)		**(p.12)**[2]	prevent the likelihood of exposure during handling
20 (1) (p.16)	Local government authorities must designate waste transfer stations to adequately and appropriately prevent the release of waste to the environment until appropriate recovery, recycling, treatment and disposal options are available.	**N/A**	Not required due to more formal settlements, streets, road access, regular pick ups, compared with unplanned settlements and no road access.
47 (3) (p.30)	Where the court convicts a person of an offence against littering, the court may, if it thinks fit, in addition to imposing of penalty, order the offender to pay by way of compensation to the public authority having control over management…to cover the cost of the removal of the litter.	**5 (23) (p.38)**	Waste collection services are subject to the obligation of persons utilising the service to pay any applicable charges.
29 (p.20)	Government authorities shall…design sanitary landfill sites based on…geological, hydro-geological and socio-economic investigations; develop respective waste disposal plans to prevent occurrence of environmental and health hazards; design site preparation and land filling operations in a way that minimizes surface water runoff and rainwater percolation into the waste and ensure that for each cell, topsoil cover is compacted to reduce infiltration of water and harbouring of vermin or insects.	**8 (p.1)**[3]	Relevant authorities and actors must ensure physical separations of waste and groundwater, soil cover systems, compaction technology and vehicles. A geohydrological investigation, an EIA and the determination of end-use requirements will be required. Soil, geomembrane and geotextile tests and leachate detection systems must take place regularly.

[2] From the Hazardous Chemical Substance Regulations (1995)

[3] From the Minimum Requirements for Waste Disposal by Landfill (1998)

7.2—The Enforcement, Expertise, Finance and Infrastructure Gaps

Tanzania lacks South Africa's expertise, its systems of enforcement, and its infrastructure. This asymmetry in implementation of relevant environmental and waste management legislation arguably goes a long way to explain why Tanzanian environmental legislation fails to fulfil its purpose while its South African counterpart does.

It is only fair to note, however, that what South Africa has achieved in relation to waste management has relied heavily on how well the country has developed economically. The City of Cape Town for example, boasts an impressive inventory of infrastructural resources that Hyman (2013, p.839) reports results in over 80% of the cities waste being collected and properly managed. Dar es Salaam, a larger city, has a collection rate less than half of Cape Town's and has very little to show in comparison to Cape Town's infrastructural inventory. The underlying impediment to Tanzania's infrastructural development is finance and revenue, which without, very little fair comparison can be made between the two cities.

Another problem Dar es Salaam faces is how to regulate its economy when such a large proportion of businesses are operating informally. As Nahman (2010, p.155) and Friedrich and Trois (2013, p.1013) report, a formalised business network in South Africa combined with a robust and waste hungry recycling industry has allowed the government to more easily rollout regulations including an extended producer responsibility programme for packaging and a levy on the use of plastic bags.

Many developments in South Africa however could be easily replicated in Tanzania through institutional reform and better guidance. Godfrey (2008, p.1660), for example, reports on the success of reporting and guidance between local and national

Table 7.2—The Enforcement, Expertise, Guidance and Infrastructural Gaps (Tanzania vs South Africa)

Study	Tanzania	South Africa
Enforcement & Expertise	Tanzanian legislation delegates the responsibilities to enforce and practice environmental law to local leaders, composed of ward leaders and ten cell leaders (leaders elected to represent neighbourhoods). These leaders are responsible for a range of governmental issues from taxation such as taxation, social welfare and land rights, yet normally do not have any government training and have not been educated past primary school level. The flaws in the enforcement system led by local leaders in Tanzania are varied. In a review of literature, Kironde (1999), Fjeldstad (2000, p.7) and Tripp (1989, p.2) all criticise the local government governance and enforcement structure as corrupt, apathetic and incompetent in dealing with environmental issues. Additionally, the DCC reported in 2012 and 2013 that less than 10% of Dar es Salaam's 73 wards reported on waste issues in their communities as required under Part Two of the Solid Waste Management Regulations (DCC, 2011).	In South Africa, waste management officers (present throughout local and national government) are delegated the sole responsibility for enforcing waste management legislation. Officers must hold competencies in environmental management, attend trainings and report regularly to higher government on their operations to be evaluated based on their performance. Waste management officers hold no other responsibility in connection with citizens on any issue other than waste management and recycling.
Guidance	Tanzanian environmental legislation does not benefit from any piece of governmental guidance. Additionally, Tanzanian legislation itself is not clear. National government acts for example are only available in English that despite being a national language, is not taught in Tanzania until secondary school level, to which the overwhelming majority of local leaders and the Tanzanian population do not achieve the ability to attend. Legislation is also most easily accessed online yet the internet penetration rate in Tanzania is estimated to be as low as 7% even in Dar es Salaam.	The South African government provides dozens of official guidance and complementary legislative documents many of which are translated in to almost all of the countries eleven national languages. These include: a 237 page guide on the Minimum Requirements of Waste Disposal by Landfill (Republic of South Africa, 2011), a 75 page National Waste Management Strategy and a citizen guide on safe and responsible disposal of general waste and hazardous waste (RCMASA, 2013).
Infrastructure	Despite stating requirements for waste transfer stations (20 (1) p.16) and sanitary landfill sites (29 p.20), Tanzania has no waste transfer stations, recycling facilities or sanitary landfill sites. The city of Dar es Salaam has under forty waste compactor trucks (including those owned and operated by Green Waste Pro, Tirima and Eco Protection) and less than a dozen governmental staff (i.e. NEMC) dealing with waste management issues in the city.	South Africa has a network of impressive infrastructure to manage and recycling waste. The City of Cape Town, Western Cape, South Africa for example has three landfill sites, three transfer stations, two materials recovery facilities, 25 public drop-off sites, 968 full-time staff and 218 compactor trucks operated by the municipal government (City of Cape Town, 2014).

Chapter 8.0—Conclusion & Recommendations

Dar es Salaam is a troubled city. As the population and economic activity booms in Africa's third fastest growing metropolis, its waste management challenges grow ever larger and more burdensome.

This study found that policy makers have a poor understanding of domestic waste levels per capita, per day, among low-income households in Dar es Salaam, and that the composition of recyclables and hazardous wastes in domestic waste streams has been neglected by previous scholarship. It additionally found a high level of public apathy towards waste management, an alarming sense of willingness among the public to break the law through illegal waste disposal practices, and a low level of public knowledge on applicable environmental legislation.

This report concludes that one obvious way for the Tanzanian government confront this apathy and waste crime is by more effectively disseminating information on the dangers of waste as well as the relevant environmental legislation. Information released to the general public should, of course, be provided in both English and Kiswahili (both online and in print) and disseminated with the help of local leaders, via public notices or even the national curriculum. Most importantly, however it must be done professionally with expert advice from professionals in environmental science.

Information however is not enough. The government must also practice what it preaches. This study found thatthe Pugu Kinyamwezi city dumpsite—the only formal and official government waste route for disposal—is not adequately managed. Indeed, it directly violates Tanzanian environmental legislation including the Solid Waste Management Regulations of 2009. Violations include the broken weighbridge, and absence of leachate protection/gas management systems/fencing/waste recycler policy.

work collaboratively to improve available collection options so waste can be routed for disposal.

A novel solution to this challenge would be to comprehensively 'map out' and 'formalise' the informal waste recycling network of individual waste recyclers. This might be done by providing training, identification and personal protective equipment to individual waste recyclers and waste recycling sites. That way this invisible human and informal infrastructural resource can be better understood and utilised by formal actors in government, the private sector and charitable organisations. As this study reports, there is currently no comprehensive data on the size or collection capacity of this informal recycler network or agreement between researchers on the monetary rewards these recyclers gain from their work.

There is little information and transparency about interesting sounding initiatives (reported by the author of this study) by, for example, NEMC, to clean up the Mlalakua River, or by the DCC, in partnering with the World Bank to improve waste management infrastructure. Such lack of transparency sends the wrong message from the Tanzanian government to the general public as well as to private, industrial and charitable actors. This study concludes that the government must make available in both English and Kiswahili, online and in print, official and written updates on all its operations and programmes.

This report concludes that charitable actors by contrast are excellent at publicising themselves but do not do enough to scale their operations; which often results in funding and human resource shortages. One way that charitable actors could improve their efectiveness is to connect with other charitable actors that address complementary development issues (i.e. public health, agriculture, business). Charitable actors, this report concludes, must do more to highlight the importance of waste management as an important public health and business issue, while the health sector and business network in Tanzania

of bankruptcy due to difficulty in receiving payments for services provided to their clients and the lack of routes for disposal in proximity to their operations. For clients, waste management contractors must be more innovative with the payment options they provide to their customers. Offering mobile money or online based payments (as one can do to pay for electricity) or requiring payments prior to services beginning would allow for greater flexibility and control of the business.

The private sector can also do more to partner with government. This report concludes that it would be desirable for waste management companies to design, advocate for and even fund alternative waste routes for disposal (i.e. waste transfer stations) in close collaboration with government. One case that illustrated the positive influence private waste management companies can have over government occurred in 2013, when those private companies convinced the DCC to keep the Pugu Kinyamwezi city dumpsite open 24/7—so special collection and dumping arrangements could take place overnight when traffic levels would not deter or prevent efficient operations.

One alternative waste route for disposal that is increasingly being promoted by the private sector is formal industry based recycling. This study reports that while the industrial based recycling market has been effectively mapped out, market trends for different materials are not well understood. An expected influx of the widely traded and lucrative PET—due to transitions by Coke, Pepsi and Tanzania Breweries Limited from glass to plastic bottling lines—has attracted the attention of large recycling industries including Bakheresa and METL, but there is much still that can be done to strengthen this market. The industrial based recycling market must push the Tanzanian government to better facilitate the plastics recycling trade, firstly by reducing the plastics levy from its current rate of 120% to a more competitive rate (i.e. 50%, in line with neighbouring Kenya) and secondly by improving the efficiency of the Dar es Salaam port as well as basic utilities such as electricity.

infrastructural improvements such as sanitary landfill sites, waste transfer stations and material recovery centres.

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